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Letter" (7x10), \$1525, and "Ready for Bed" (8x10), \$1600.

George I. Seney sale, March, 1885: "The Poacher" (21x16), Knoedler, \$1725; "The Herd Boy" (18x14), J. T. Martin, \$3100; "Bettina" (8x9), Schaus, \$1375; "The Evening Walk" (16x23), Knoedler, \$3050; "In the Hay-field" (31x24), C. P. Allis, \$5500.

George Whitney sale, December, 1885: "The City Girl" (8x10), E. W. Bass, \$2500.

Mary J. Morgan sale, March, 1886: "A Farmer's Daughter" (9x7), J. J. Astor, \$2300; "A Young Satyr" (10x8), S. D. Warren, \$3150; "St. Martin's Day" (16x21), Knoedler, \$5700; "The Hunter's Repast" (19x24), Mrs. M. A. Ogden, \$16,400; "The Country Store" (30x25), Avery, \$10,400.

Wall and Brown sale, March, 1886: Head (10x9), Schaus, \$1300.

A. T. Stewart sale, March, 1887: "The Children's Party" (47x32), Jay Gould, \$21,300.

Albert Spencer sale, February, 1888: "Les Amours et les Roses" (6½x9), Knoedler, \$2100; "Le Salut des Amours" (6½x9), J. E. Waggoman, \$1550; Head of a Brunette (9x10½), Daniel Catlin, \$3000; "Drove of Swine—Evening" (14x18), C. Lambert, \$2050.

THE SCIENCE OF COLOR.

THE appearance of a new edition of Professor A. H. Church's "Manual of Color," published by Cassell & Co., should be welcomed by students of art, were it only because it shows plainly that science is not yet, and is not likely soon to be, in a position to direct the practice of artists or decorators. The methods pursued by scientists, of examining only the colors of the solar spectrum and of eliminating, as they would say, the personal equation, by making no account of the unusual sensitiveness to color which belongs or should belong to the artist, make it unlikely that their results should be of much service to the latter. It is true that some of them, like M. Chevreul, have been at the trouble to formulate general laws, which they have offered as guiding truths to the artistic world; but the fact has been proven and accounted for that these laws, though scientifically true, are artistically of little value. After Chevreul, Rood, with less pretensions and more regard for the opinions and practice of artists, offered some suggestions, which have met with very little attention; and now Professor Church, in devoting to the artistic side of his subject many pages of his book, exhibits a modesty which might cause his remarks to be overlooked altogether, if attention were not called to them. And yet they have their importance in providing scientific grounds for many of the dicta of artists about color which are not commonly received with becoming respect by laymen, and in pointing out that scientific truth, dealing, as we may say, with the skeleton of nature, need not be expected to be always in accord with artistic truth, which deals with her living body and spirit. The book is, still, a manual, intended for students of science, not for art students. The greater part of it is taken up with descriptions of experiments with the prism, with revolving disks and Iceland spar, few of which are new, and only some of the results of which concern us. We will dwell on this part of the book only long enough to remark that Professor Church thinks the analogy between music and color, which has furnished so many useful terms to artists and art critics, is more fancied than real. The differences which he points out, however, are not such as most people will consider decisive on this point. Some years ago the idea of analytically examining the timbre of an instrument, it is safe to say, would have been considered mere folly; yet Helmholtz has done this; and some one may yet do as much, in a strictly analogous way, for tones of color. The problem is, no doubt, much more complicated; but it would be rash to say that it is wholly unsolvable.

Before proceeding to that part of the book which is of especial interest to the art student, we must caution him, should he read the whole, against adopting the nomenclature set down in Chapter V. For scientific purposes it may be valuable and sufficient, but the same terms are given different meanings and others are added in the discussions of the studios and of the art columns of the newspapers.

An important difference between the results arrived



"THE ORGAN-GRINDER." BY LUDWIG KNAUS.

at by rotating diverse colored disks and mixing on the palette the same pigments is pointed out in Chapter VII. It is well known to artists that to mix colors is to dull them, while the scientist knows that to mix colored lights is to secure increased brilliancy. A diagram shows that to secure by rotation the effect of a mixture of violet carmine and Hooker's green an amount of black had to be added more than equal to that of the two colors together. A little vermilion had also to be sup-



"THE GIPSIES." FROM THE PAINTING BY LUDWIG KNAUS.

plied, in order to match the brownish tint of the palette mixture. Generally it would appear that the mixture is less luminous than the average of its components and also that it tends in the case of warm colors to increased warmth—that is, to browns; in the case of cool colors to cooler grays. This, of course, gives support to the practice of good colorists, notably among "impressionists," in placing colors close together on the canvas in unblended threads or hatchings, instead of mixing them on the palette.

Professor Church does not believe in retaining the name of "tertiaries" for broken tones, such as brown, maroon and citrine. He claims that a combination of green and orange pigments, for example, is equal to one of the spectral colors, which may be thus expressed: green + red + green + black. To explain this, it is necessary to say that Professor Church, like most scientists of today, rejects the primary colors of Brewster—red, yellow, blue—for those previously named by Young—red, green, blue. Green and red producing bright yellow with the spectrum colors, an addition of green to yellow makes a still brighter yellowish green, which when sufficiently lowered with black matches the citrine produced by the mixture of pigments given above. We mention this because some teachers find in it, though without a shadow of reason, an excuse for the practice, which they inculcate, of lowering all tones with black. The fact is that when reading any scientific treatise on color, one cannot too distinctly keep in mind the fact that we do not paint with the spectrum colors, nor even do most of our pigments approach them. Normal red is only "approximately represented" by scarlet vermilion washed over with madder carmine. Orange "is seen in tolerable perfection" in cadmium yellow; "emerald green is not a pure typical green, but contains a decided trace of blue." The purple which should go with full green as a complementary he tells us is perhaps most closely represented by the flame of burning cyanogen. Now, burning cyanogen can no more be given a place on the palette than can the spectral violet.

This brings us to a consideration of the law of complementary colors, a law which has had a worse influence upon decorative design than any other discovery of the scientists. This law as established by M. Chevreul is, briefly, that certain pairs of colors, green and purple, for example, or red and blue green, when combined, make up white light. Lower tones may be selected which will make not pure white, but a lowered white or neutral gray. These also are reckoned as complementaries. Now, as when one of a pair of complementaries is presented to the eye until the retina grows tired of it, not only does the other offer the most complete relief, but the sensation given by it is then exceptionally pure and full. From this the practical rule was deduced that to make a harmonious balance of colors it was requisite that they should be such and so proportioned as to be equal to a pair of complementaries, or, when combined, they should produce white or a light gray. Lists of such colors were made out, and manufacturers in many instances made their designers work in accordance with the rule. A certain artist decorator of New York went so far as to cause his subordinates to make use habitually of Maxwell's rotating disks, by which one can determine, for example, the exact shade and tint of grayish turquoise, which is the complementary of a certain amber tone.

But, as Professor Church points out, while complementary pairs of strong bright colors offer the strongest effects of contrast, the very strength of these effects often makes them undesirable. Pairs of a lower tone may be used with less reserve or a dividing line of white or black or gold may be used to mitigate bad effects; but commonly all these combinations look poor and unsatisfactory. Better results are usually got by combining colors more nearly related, only about 90 degrees apart on the chromatic circle instead of 180. Even this result, as worked out in lists of so-called harmonious assemblages of colors by Rood, Brücke and Professor Church, will be called in question by most artists. Professor Church calls the combination of scarlet with violet, bad; but scarlet and blue, good. Blue green with turquoise he calls bad; but orange red with turquoise, good. Even with regard to flat tints of opaque colors few decorators will agree with him in these opinions.

In another part of his book he sets this matter in the right light when he says that the chromatic balance

bears little relation to the psychological balance, and that, again, to the æsthetic. The latter alone concerns the decorator; and to secure it he must pay attention not to the "normal" tones of the spectrum, nor even to the nearest possible approximations to them in enamels, but to the actual pigments, metals and other materials which he may be using. In these the color will be affected in countless ways by their opacity or transparency, dulness or polish, texture and minute composition, not to reckon just now effects of iridescence, opalescence and changeableness and inter-penetration of hues. Then, again, the decorator would surely find himself embarrassed if he were to set out to discover a complementary for every important piece of color in a room, by the fact that each color influences every other, some more, some less, according to position, distance, lighting and so forth, so that the contrast really needed may be found in some object which would never be suspected to be capable of furnishing it. Added to all these considerations, which are purely practical and physiological, are those much more difficult to define, which depend on the associations which we connect with certain colors. Thus blue may remind us of the sky; bright green of foliage; and the colors of flowers of the flowers themselves. It is, besides, impossible, in practice, to divorce color from design, as regards the effect of both together upon the mind.

A scientific basis is offered by Professor Church for the distinction between retiring and advancing colors. Though in part founded upon the bluish tint of distant objects, he thinks it likely that the smaller refrangibility of the red, orange and yellow rays has much to do with it. The great luminosity of the same rays, which represent more than two thirds of the brightness of white light while the area which they occupy in the spectrum is less than one third, he supposes to account for the fact that these are felt to be warm colors. We cannot agree with him, nor quite follow his reasoning.

This is the scale of moonlight, the prevailing color of which, according to Professor Church, is a faint green. Deep folds in colored draperies show the same peculiar-

de Naples it would be well to have a tube of *jaune brillant*, which is a fine pale orange yellow. The single green may be supplemented by green lake. Some other transparent brown, as Van Dyck brown, should be used instead of bitumen, which has many bad qualities. That would make a very useful palette of twenty colors.



"THE BURGOMASTER OF IMMENSCH." BY LUDWIG KNAUS.

FACSIMILE OF A CRAYON DRAWING BY THE ARTIST.

ity. Red becomes purplish; orange, brown; yellow, olive green; ultramarine, violet; purple, violet.

On many of the points which we have rapidly run over Professor Church writes at length, giving detailed directions for experiments, which will be of the utmost value to whoever would engage in this interesting branch of scientific study. To artists, however, his most significant words are those in which he points out the limitations beyond which this study cannot help them. "We try to trace out the causes of the vast number of color sensations which we are constantly receiving," he says, "but we constantly find that the cold methods of analysis fail to explain the mental appreciation with which we regard the astounding fertility of nature in its gifts of color. . . . Still experiment and analysis are serviceable tools in the hands of the artist who seeks to reproduce, to modify or to develop in tangible form the happy combinations and arrangements of color with which his mental recollection is stored."

THE following palette is recommended by the French painter Robert for the use of students in oil painting. The pigments should follow in the order given, beginning at the right hand. They being of French make, we give as far as possible an English translation of the names:

<i>Blanc d'Argent</i> , Silver white.	<i>Terre de Cassel</i> , Cassel earth.
<i>Jaune de Naples</i> , Naples yellow.	<i>Brun Rouge</i> , Brown red.
<i>Chrome clair</i> , Chrome yellow, pale.	<i>Laque de garance, clair</i> , Garance, light.
<i>Jaune de Chrome, foncé</i> , Chrome yellow, deep.	<i>Laque de garance, foncé</i> , Garance, deep.
<i>Ochre jaune</i> , Yellow ochre.	<i>Vert émeraude</i> , Emerald green (not at all like the English pigment of this name).
<i>Jaune Indien</i> , Indian yellow.	<i>Cobalt</i> , Cobalt.
<i>Vermillon</i> , Vermilion.	<i>Outre mer</i> , French ultramarine.
<i>Ochre de Rhu</i> , Ochre de Rhu.	<i>Bitume</i> , Bitumen.
<i>Sienna naturelle</i> , Raw Sienna.	<i>Noir ivoire</i> , Ivory black.
<i>Sienna brûlée</i> , Burnt Sienna.	<i>Bleu minéral</i> , Mineral blue.

The chrome yellows may be replaced with advantage by cadmiums of the same shades. In addition to *jaune*

falling from the balustrade of the little gallery which runs across the end of the vast studio, and which has

half hidden under it a beautiful moucharabia. Moorish armor dating from Boabdil, poniards with scabbards of silver, Arab guns with long barrels inlaid and incrustated, yataghans with Arabic inscriptions, Kandjars with sheaths of velvet studded with garnets, turquoises and coral, pipes in damascened steel, cupboards in ebony, inlaid tables, Persian mirrors in painted frames and perfume burners in wrought copper, Morocco saddles and trappings, flags surmounted by the crescent, shine and gleam, as says Mr. Eudel, "like the rain of stars of some colossal firework show."



PEN SKETCH OF PEASANT CHILDREN. BY LUDWIG KNAUS.



PEN SKETCH BY LUDWIG KNAUS.

The modification of color by illumination offers some peculiarities worth noting. A reduction of the luminosity of a pure bright solar spectrum works two kinds of changes in the colors, which result, if the process is continued, in reducing their number to red, green and violet.